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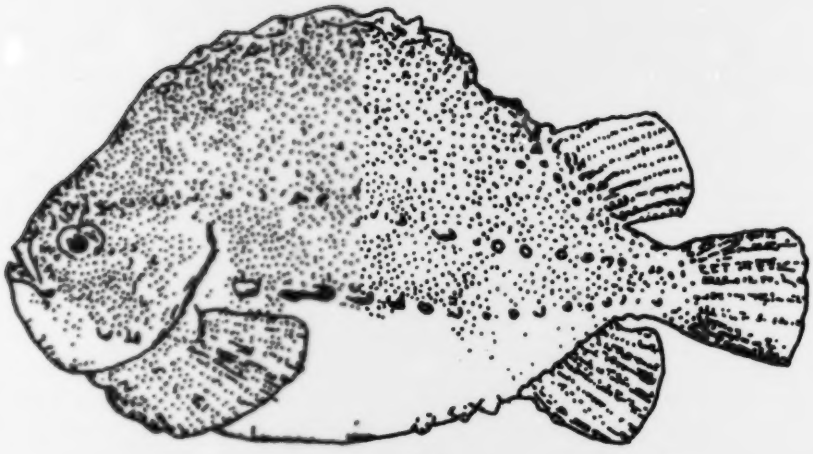
GOVERNMENT OF NEWFOUNDLAND AND LABRADOR
DEPARTMENT OF FISHERIES

LUMPFISH ROE FISHERY DEVELOPMENT IN NEWFOUNDLAND DURING 1981



DEVELOPMENT BRANCH REPORT NO. 26

February 1982

Lumpfish Roe Development
In Newfoundland and Labrador
During 1981

Project Co-ordinator: Ken Mercer

by

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Government of Newfoundland and Labrador

Department of Fisheries, Development Branch

Fishing Operations Unit

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ABSTRACT

The lumpfish roe fishery in Newfoundland began in the late 1960's and has now become an established fishery yielding (based on average of the last 5 years) 627,000 kgs. valued at $400,000.00. The more traditional fishing areas along the east coast and Avalon Peninsula have experienced reduced landings; however, newly developed areas along the south coast are recording excellent landings and accounted for 15 percent of the total 1981 landings. Thus far, no lumpfish has been found along the Labrador coast in commercial quantities. Exploratory fishing conducted in Sandwich Bay (Labrador) during June and July yielded only 22 lumpfish in the 100 sq. mile area fished. One report from an inshore dragger did indicate lumpfish to be abundant in the Forteau - West St. Modeste area.

Utilization of lumpfish carcasses for bait on groundfish longlines and in lobster pots was investigated and two (2) separate tests indicated that lumpfish is a poor substitute for herring and squid bait. Data was collected on the catch or yield of roe per unit effort for various regions; this varied from a low of .98kg/net day in traditional areas to 11.5kg/net day for the newly developed areas.

In an effort to determine the present status of lumpfish stocks, this Department, in conjunction with Federal Department of Fisheries and Oceans, initiated a limited tagging program in 1981 which will be continued in 1982. A total of 552 fish were tagged; all except two (2) were female. One recapture, to date, has been recorded.

Also biological studies were carried out in 4 selected areas and meristic data indicate that the length of female lumpfish tends to decrease towards the north. Preliminary analysis of the data indicates that lumpfish in the Labrador region may be a separate stock.

Discussions are provided on future utilization of lumpfish carcasses, secondary processing of roe and the need for further population assessment to develop the fishery in an orderly manner.

INTRODUCTION

Assistance to various sectors of industry towards development of the lumpfish (Cyclopterus lumpus) roe fishery is part of an overall program of the Provincial Department of Fisheries to utilize all commercially potential species. Previous efforts in lumpfish roe development have been documented in other Departmental publications (Allan - 1978, Warren, 1979 and Sturge, 1980).

During 1981, the Department continued to promote lumpfish development particularly in harvesting with emphasis on fishing demonstrations and the provision of technical assistance to fishermen and processors in areas of the Province with little or no history in this fishery.

Development of the commercial lumpfish roe fishery during the past few years has raised concern that available scientific information regarding the "status of fish stocks" is inadequate for any long-term projections. This situation causes a degree of uncertainty throughout the industry and has been one factor in deterring a significant investment in various sectors particularly secondary processing.

In fishery expansion, development and research should go "hand in hand" and usually complement one another. During the past 10 years, while the lumpfish fishery has expanded, no biological research has taken place; consequently the status of lumpfish stocks are unknown. It is difficult to implement orderly development while lacking sound scientific data as a background for decisions affecting the fishery. It is for

this reason that the Provincial Department of Fisheries has begun limited biological studies to more fully determine the future potential of the lumpfish fishery.

This report outlines the results of development efforts during 1981 and provides an insight for some suggested direction of Government efforts in the future.

THE COMMERCIAL FISHERY 1981

(An Overview)

Introduction

The commercial fishery during 1981 can be considered a successful one despite a virtual failure in many of the previously good fishing areas.

The total landings for 1981 was 728,433Kg of roe which represented an increase of 73% above 1980. This is attributed to an expansion of the fishery in the South-west Coast area and a good fishery on the South Coast.

Materials and Methods

Catches were determined by contacting plants that process roe and obtaining their landings for the past season. Methods of processing roe and information regarding fishing techniques have been documented in the reports previously noted.

Results

Although 1981 total landings were increased considerably from previous years, there were areas where the fishery has declined and many landings were below commercial levels.

For the purpose of this report the main fishing areas throughout the Province are shown in Figure 1 and listed as follows:

(a) Northeast Coast - Comfort Cove - Port Rexton

(b) Avalon Peninsula - Conception & Placentia Bays

(c) South Coast - Burin Peninsula - Seal Cove

(d) Southwest Coast - Rose Blanche - Codroy

(e) Northern Peninsula

The 1981 catch data for each of these areas is contained in Appendix A, Table 3.

(a) Northeast Coast Area.

The Northeast Coast had very low landings during the past season and this influenced the overall fishing effort. Weather conditions were good throughout the season and fishing began around the first of May. Catches, however, were low and many fishermen ceased fishing after the first couple of weeks.

A succession of successful seasons encouraged Northeast Coast fishermen to acquire additional gear, i.e. approximately 20-30 nets. However, because of the low 1980 and 1981 landings the fishermen now feel there is no advantage in further increasing their number of nets and some are even cutting back on their net inventory.

The highest landings in this area during 1981 occurred at Comfort Cove, Notre Dame Bay where fishing was initiated this year. The Department assisted by issuing nets to a fisherman on an experimental basis and by supplying processing equipment to the local plant until they obtained their own.

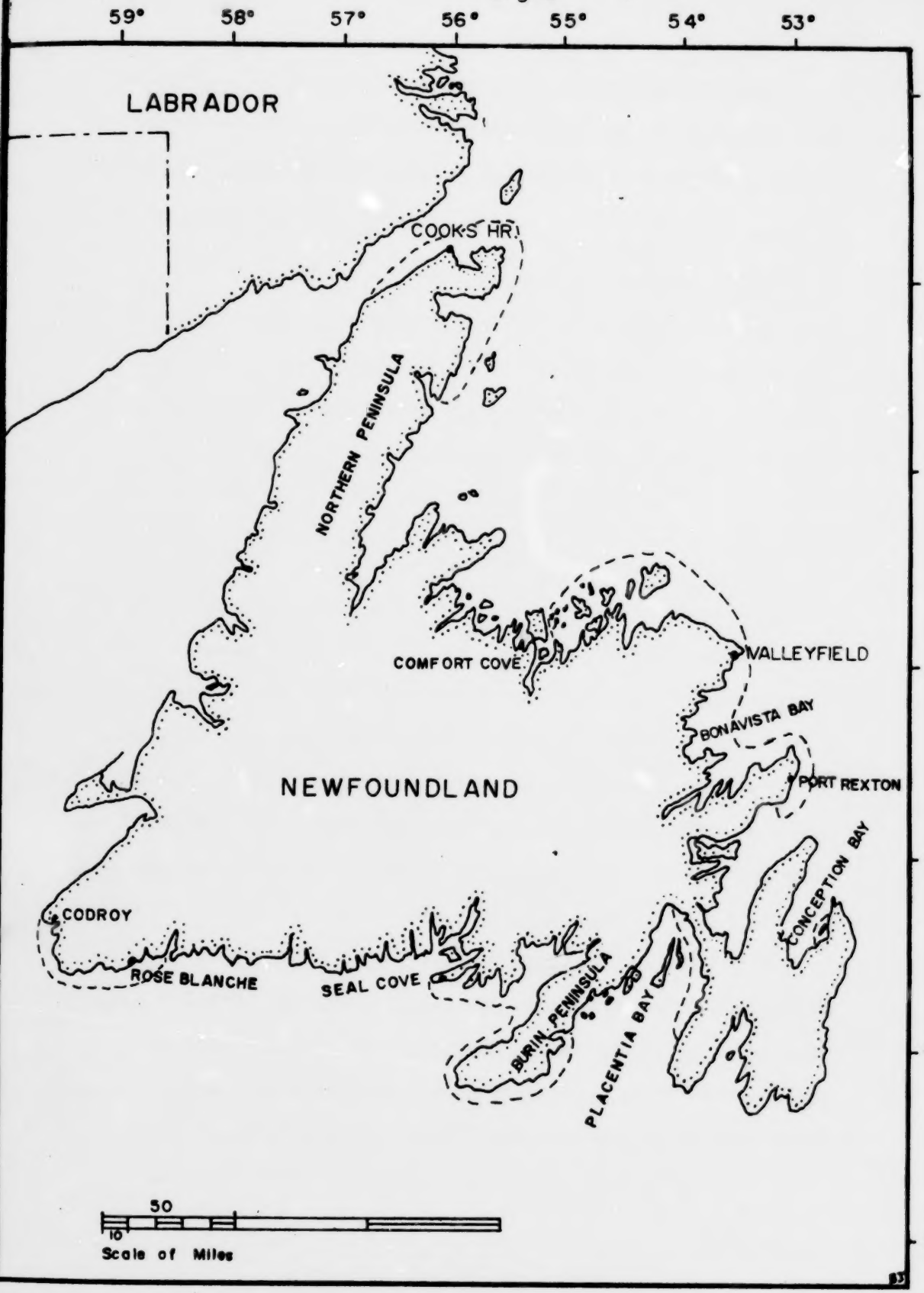

Fig. 1: Lumpfish Roe Producing Areas in Newfoundland, 1981.

Many fishermen in this Northeast Coast area believe that environmental factors are responsible for the decrease in catches and that the fishery will increase again when conditions are more ideal. They believe that abundance of lumpfish is influenced by the amount of ice present.

(b) Avalon Peninsula.

The Avalon Peninsula fishermen experienced low catches and problems in selling the roe. This resulted in either fishing being discontinued or a reduction in fishing effort.

(c) South Coast.

The South Coast was once again the leader in roe landings, this has resulted in a rapid expansion both in the number of fishermen and the amount of gear. The "lumpfishery" in Seal Cove, Fortune Bay was a tremendous success this year, catches doubled the 1980 landings and all roe taken was shipped by collector boat to Grand Bank. The fishery started in late April and catches per boat averaged from 600-1000 lbs. of lumpfish roe per day for the first few weeks then decreased slightly.

Early in the season there were complaints by lobster fishermen that their landings were adversely affected by lumpfish carcasses which littered the fishing grounds. It appeared that lobsters tended to ignore the bait in traps when a ready supply of other food was available.

Many fishermen on the South Coast have come to rely upon the lumpfish roe fishery as an early source of income prior to the startup of the groundfish fishery.

(d) Southwest Coast.

The Southwest Coast is the most recently developed area and the results to date are good. In Codroy, three fishermen were issued nets on an experimental basis and all did exceptionally well.

There is no disposal problem with the carcasses in this area since the local plant utilizes them for fishmeal. Landings were good throughout the area and all those involved were pleased with the fishery and hope to pursue it again next season.

(e) Northern Peninsula.

The Great Northern Peninsula is an area where fishermen have pursued the lumpfish roe fishery for more than a decade. Despite the lengthy fishery, catches have not fluctuated greatly. The effort has remained fairly constant over the years and the fishermen use only 5-10 nets each and regard the fishery as a supplement to the salmon and lobster fishery. At the present level of effort the fishery should continue to provide fishermen with an income for many years. The 1981 fishery started in late April and continued to mid-June with weather conditions being excellent.

Fishermen in the Bonne Bay area, prompted by by-catches of lumpfish, have expressed interest in a directed fishery for this species. Exploratory fishing with standard lumpfish gear is required to determine the prospects for a commercial fishery.

The catches of lumpfish roe for the past 12 years are shown in Table 4, Appendix A.

Discussion

The province-wide increase in roe landings during 1981 is attributable to many factors. Weather conditions were much improved in comparison with 1980 when gear was unattended because of storms, for up to 10 days. In 1981,catches of fish in areas which had no previous lumpfish fishery amounted to over a quarter of a million pounds. This is largely due to the Department's development program. Another factor contributing to the increase was the expansion of the lumpfish fishery in the southern portion of the Province which compensated for low catches in the more traditional fishing areas to the northeast. The rapid expansion of the fishery on the South Coast resulted in a high catch in recent years and it will be interesting to see if catches maintain their present level in future years.

The development of a secondary processing industry for lumpfish roe caviar must be seriously considered since this would mean an extended season for workers involved

in the lumpfish fishery. The amount of roe landed would be sufficient to keep at least one processing facility operating year round especially since bulk roe that is normally exported in large barrels may be held in storage and processed any time throughout the balance of the year depending on working and market conditions.

LUMPFISH DEVELOPMENT ACTIVITY 1981

Exploratory Fishing

Introduction

In addition to providing technical assistance to new operations both in harvesting and processing of lumpfish, throughout the Province, two areas - Trepassey Bay and Sandwich Bay (Cartwright Area) were designated experimental zones and directed exploratory fishing was conducted.

These areas were selected upon request from local development associations and fishermen's committees who considered their respective areas to have sufficient resources for commercial lumpfish operations.

Materials and Methods

Exploratory fishing at Cartwright was carried out by a local fisherman under the supervision of a project officer. An eighteen foot "speed boat" was used in the operation. Six"fleets"(each with two standard commercial nets) were set and then moved each day for resetting in designated areas of the Bay.

At Trepassey, arrangements were made with a fisherman operating a 39-foot longliner to use 10 standard commercial lumpfish nets. Again, fishing areas were designated and the catches recorded for each area.

The selection criteria for all fishing stations were water depths, bottom conditions and previous reports from local fishermen of lumpfish occurrence.

Catch Results

Sandwich Bay

The area surveyed in Labrador is shown in Figure 3 Appendix B, and covers approximately 100 square miles.

Fishing effort totalled 60 net days during which 22 lumpfish, 11 skate, and 3 rock cod were caught. (Table 5, Appendix B). All lumpfish taken were small in comparison with samples from southern areas (Table 5, Appendix B); however, 90% of the females were sexually mature.

Trepassey Bay

The Trepassey area (Figure 4, Appendix B) was surveyed in late June to early July. During that period 9 lumpfish were taken in a total of 150 net days. Several of the fish were post spawners and were captured in 24 fathoms of water. The by-catch of 173 flounder and 6 skate is worth noting because the mesh size used in the lumpfish fishery is very selective and catches of flounder and skate sometimes exceed catches of lumpfish. A lumpfish net is slight compared to a groundfish net and does not have the durability to withstand the strain of deep water fishing. The fishermen involved in the exploratory fishing plan to continue this fishery next year with an earlier commencement schedule.

Discussion

The catch results from both exploratory areas suggest that stocks sufficient for commercial operations were not available at that particular time. However, the Trepassey area was surveyed late in the season and the lumpfish may have spawned and moved into deeper water.

Reports received from Southern Labrador indicate an abundance of lumpfish in the area. The M.V. Oderin reported a large number of lumpfish taken while dragging off Forteau, Labrador and there have been reports of lumpfish in gillnets in the West St. Modeste area.

Future Utilization of Lumpfish Cracasses

Introduction

Presently, the lumpfish fishery is based on the roe of the species and the carcass has very limited usage. During the 1981 fishing season, an estimated 5-6 million pounds of lumpfish carcasses were discarded because of no available market. Reportedly, high water content and low protein yield is responsible for the low demand by fishmeal processors for the carcasses. In 1980 and 1981, several plants bought carcasses for fishmeal but the price paid to fishermen was low.

The Department is examining alternate uses for the lumpfish as any utilization of this potential source of protein would give added value to the fisheries catch and relieve fishermen of the unproductive and indiscriminate dumping of the carcasses.

Materials and Methods

The first attempt at utilizing the carcass, other than for fishmeal, was carried out in Codroy. Lumpfish was cut into bait-sized portions and used to bait lobster pots, the pots were baited in a 2 : 1 ration - herring to lumpfish. The pots were fished for a total of 3 days and all catches were recorded.

A second baiting experiment was carried out using lumpfish and basking shark as bait on longlines, fishing for cod. This test was done in two areas namely, St. Brides in St. Mary's Bay and Renews on the Southern Shore. In both cases, the new bait types were compared with squid on (1) baiting efficiency in the automatic "trough" baiter system, (2) ability to stay on the hook and (3) ability to catch fish.

Results

The testing of lumpfish for use as lobster bait was carried out in Codroy in May of 1981. Of the 70 traps set out, 45 contained herring and 25 contained lumpfish, the latter number was reduced, because of a storm, to 21 pots. The lumpfish body (less the head) was the main portion used for bait in this test. The results indicate lumpfish to be a poor substitute for herring in lobster pots (Table 7, Appendix C).

The number of lobsters taken by herring bait totalled 47 in 45 pots over a three day period. The 25 pots baited with lumpfish caught 13 lobsters during the same time period.

Testing lumpfish as bait on groundfish longlines was carried out in the Renews area on October 14, 1981. The lumpfish was cut into bait size pieces and used in an automatic "Gill"*type baiter. The results can be seen

*A locally developed mechanical baiter that attaches bait randomly to the hook as the longline is drawn through a bait trough.

in Table 8 (Appendix C). Because of its poor baiting efficiency along with low catch rates it was determined that lumpfish was not a suitable bait for codfish. The total catch of 12 fish on 6 lines* was extremely low compared to the catch of 712 fish on 36 lines* baited with squid. The total catch for the day was 3,000 lbs. which was approximately the same as the individual catches of other boats in the area.

Discussion

The problem of what to do with the millions of pounds of lumpfish carcasses dumped annually is a difficult one. The carcasses are discarded on the fishing grounds and create problems for lobster fishermen, hence the necessity of obtaining adequate means of disposal. The poor results of lumpfish as bait for codfish indicated that it is not suitable for that particular species or fishing method. The moderate success of this type of bait in lobster pots requires further testing which would include more regulated random baiting of pots on each fishing day.

Further studies may be directed towards (1) expansion of its use in fishmeal production, (2) the use as a bait for other species such as the eel fishery and (3) its suitability for human consumption and pet food.

*Each line contained 86 hooks.

Catch Per Unit of Effort (CPUE)

Introduction

In order to fully understand trends in lumpfish operations throughout the Province, data on catch in relation to the amount of effort was collected. Catch per unit effort, as explained in the previous section, is presently used in measuring the degree of commercial viability on an annual basis and assists in determining the development potential in adjacent areas. Also, such data collected over a number of years may be used as a parameter in determining stock size and consequent resource potential or projection.

Materials and Methods

Information on CPUE was collected in the Catalina - Valleyfield area by contacting fishermen and plant managers regarding the number of fishermen actively engaged in the fishery and the amount of gear being used.

In other areas the CPUE was determined from fishermen's reports of the number of net days and the total catch; these reports were submitted weekly by fishermen who were fishing nets issued by the Department for experimental purposes.

Results

The CPUE data as listed in Table 1 reflects the type of "commercial" fishery in each area. The highest catch was experienced in the areas which were recently recorded for the more traditionally fished areas (i.e. Catalina &

Greenspond). However, all regions recently fished have not experienced high catch rates, an example being the Avalon Peninsula which recorded the lowest CPUE of the 4 Nfld. regions.

Table 1: Catch per Unit of Effort for various Regions

Region	Place	No. of Net Days	Yield of Roe (kg)	Roe Per Net Day (kg)	Regional Average (kg)
Northeast Coast	Catalina	225	220	.98	3.8
	Comfort Cove	230	1,669	7.38	
	Greenspond	180	568	3.20	
South-west Coast	Codroy	894	10,342	11.50	11.0
	Isle Aux Morts	838	8,739	10.40	
South Coast	St. Lawrence	480	1,448	3.00	4.4
	Grand Bank	90	514	5.70	
Avalon Peninsula	Ship Harbour	210	208	1.00	1.2
	Bell Island	635	846	1.30	

DISCUSSION

Generally, the lumpfish fishery is not a highly lucrative investment for fishermen and most operations are carried out concurrent with the harvest of other species.

An exception to this in 1981 was the high rate of return by fishermen on the Southwest Coast where some fishermen grossed up to $1,000.00 per week.

The catch per unit of effort is a useful method of comparing the fisheries in various areas, however, it can,at times, be misleading because in certain fisheries not all fishermen may have the same fishing experience or proficiency. Since the lumpfish fishery is a relatively simple operation, experience would not be a significant factor in the CPUE. It is acknowledged that there may be difficulty interpreting catch effort data for areas where fishermen adopt an "all or nothing attitude"; that is, if there is not a good weeks pay to be made then they will concentrate their efforts in another area. A fairly constant effort is maintained by lobster and salmon fishermen who find it profitable to check their lumpfish nets during the course of other fishing activities and this provides supplemental income for a little extra labour or fuel costs.

Several questions should receive attention during the upcoming fishing season, and these are: (1) Will the catch per unit effort along the South-west Coast remain high? and (2) Will the intense fishing effort being experienced along the South Coast result in a decrease in catch similar to the occurrence along the North-east Coast several years ago? Answers will give some indication of the size and distribution of the lumpfish stocks.

Tagging Operations

Introduction

The migratory patterns of Cyclopterus lumpus are not well understood, the consensus being that the fish move inshore to spawn in early spring and move back into deeper water around the end of June after spawning has taken place. During 1981 this Department in conjunction with the Federal Department of Fisheries and Oceans initiated a lumpfish tagging program. The purpose of this tagging is to monitor seasonal movements or yearly migrations to other spawning areas or between different stocks. The length of each tagged fish was recorded in an attempt to obtain information on growth rates in the natural environment.

Materials and Methods

The Department of Fisheries and Oceans supplied the necessary materials for the tagging program and agreed to be responsible for rewards to fishermen sending in tag returns. All fish for the tagging project were captured using regular commercial gillnets. The tag selected is commonly known as the "Spaghetti" tag and was attached to the right side of the dorsal hump, approximately two-thirds back the length of the body (Figure 2).

Results

Tagging was carried out in 4 areas of the Province. The first tags were applied on June 23 in Cartwright, Labrador, during exploratory fishing when 23 fish were

tagged, the number being limited by poor catches. Lumpfish were tagged in Catalina and Codroy on June 29 and July 2nd, respectively. Only a low number of fish were tagged in these locations because the commercial fishery had ended and the fish had spawned and moved into deeper water. Tagging in the Grand Bank area took place on June 29 to July 1 with a total of 514 fish being tagged.

Care was taken when tagging the fish to ensure it was not adversely affected by the tag or the tagging procedure. Each fish was tagged and measured as soon as it came onboard and immediately released and observed until it swam out of sight. If it was unable to submerge, another was tagged in its place, however this was not a regular occurrence.

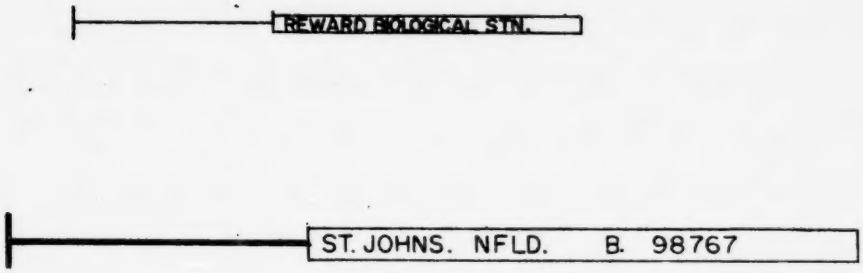

Figure 2: Spaghetti Tag

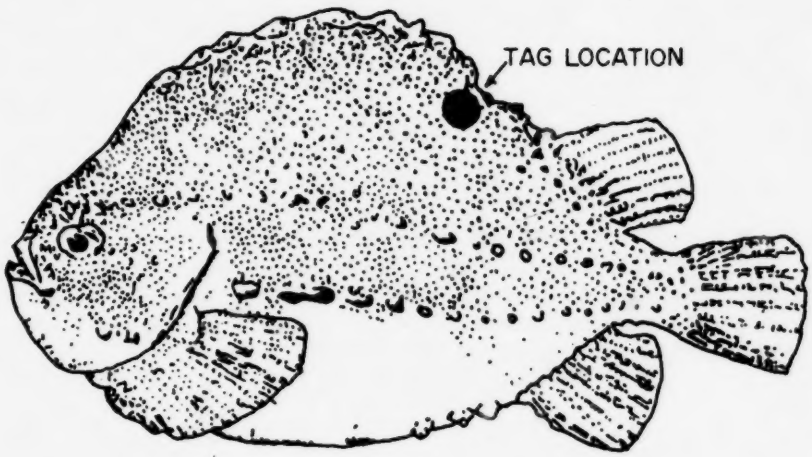

Figure 2: Lateral View of a Lumpfish showing Location of the Tag

The Spaghetti tag was selected because (1) it can be quickly applied, thus shortening the time the fish is out of water and (2) it is easily detected because of its bright orange and yellow colours.

The only reported fish recaptured to date was taken in 50 fathoms of water off St. Bernard's, Fortune Bay, a distance of 60 miles from the location where it was released.

Results

Table 2 - Results of lumpfish tagging Operations conducted during 1981.

Area	No. of Fish Tagged	No. of Returns*
Grand Bank	514	1*
Codroy	8	None to Date
Catalina	8	" " "
Cartwright	23	" " "

*As of December 1, 1981

Note: The return from Grand Bank area was caught in 50 fathoms of water off St. Bernards in Fortune Bay during October.

Discussion

It was not expected that many tagged fish would be recaptured during 1981 since the fishing season closed shortly after the tagging. Thus, tagged fish will have one year to migrate and grow before being recaptured during the 1982 commercial lumpfish fishery. All tagged fish, except 2 in the Codroy area, were adult females.

Biological Data

Introduction

The lumpfish is not at all fusiform in shape, being very stout with a dorsal hump that conceals the first dorsal fin and has a tough leathery skin covered with tubercles. The lumpfish is primarily a bottom dwelling fish. Being a very poor swimmer it spends most of its time attached to rocky bottom by a suction disc which is an adaption of the pelvic fins. The feeding of the lumpfish is not well reported. The lack of information is attributable to the fact that most sampling occurs during the commercial fishery which coincides with the spawning season. Stomach samples, taken during the 1981 season, contained only a white, milky liquid and may indicate that little or no feeding occurs during spawning.

Cox & Anderson (1922) reported that winter feeding occurs in deep water and the food consists entirely of invertebrates.

The lumpfish migrate inshore to spawn in mid-April and spawn around mid-June depending upon water temperature. The female lays her eggs on the bottom in a mass that soon hardens; this mass of eggs is then fertilized by the male who guards the eggs and aerates them with his pectoral fins.

Insofar as our lumpfish populations are concerned, no information is available concerning migrational patterns, growth rates, and whether or not there are separate stocks in various geographical areas of the Province.

In order to provide better background information for orderly development of this fishery, the Department in 1981 conducted limited biological research through a tagging and sampling program.

Sampling was conducted to obtain total and gutted weight, length, roe yield and vertebrate count. The latter was for use in meristic studies and aging determinations.

Materials and Methods

Information regarding sex, length, total weight, roe yield and gutted weight was collected in 4 different areas

of the Province each representing a specific geographical region. In all cases samples were obtained from local fishermen using standard commercial gear (i.e. 10½-11 inch mesh. gillnets)*: One fishermen in Codroy used, in addition to the lumpfish nets, regular 5-7 inch mesh, cod gillnets.

A measuring board and set of scales were used for length and weight determination. The roe was then removed from the fish by opening the body wall, after which the roe and carcass were weighed separately.

Results

Lumpfish are generally distributed around the Island and are considered to be approximately the same size as the European lumpfish. The largest lumpfish taken from the Northwest Atlantic was 60cm (Leim & Scott, 1966). In 1981, at Grand Bank 4 fish were measured at 60cm and one fish at 64cm, the latter exceeding the maximum length recorded in literature cited. However, since the project observer involved released all fish during tagging operations, the record cannot be verified.

Table 9 (Appendix D) shows that the lengths of female lumpfish tend to decrease in northward latitudes. This is common in some species of fishes and food availability (See Figure 5 - Appendix D).

*In this report gillnet sizes are stretched mesh measure.

The difference in length and the separation of the standard deviations indicate that lumpfish found in the Labrador region may be a separate stock from the rest of the Island. Further studies of meristic counts and tagging experiments are needed to determine whether separate stocks occur in other geographical areas of the Province.

Samples taken in areas with an ongoing commercial fishery might be expected to have a higher proportion of smaller fish because of gear selectivity than areas such as Cartwright where there is no history of a directed lumpfish fishery. The lumpfish taken at Cartwright although small were sexually mature indicating a slow growth rate or early maturity. By comparison, lumpfish taken in Catalina, of less than 40cm, tended to be immature. Because of the body form of the lumpfish, a small increase in length can mean a large increase in overall size. The commercial size usually ranges from 38cm to 52cm in which there may be a number of year classes. The year classes are hard to detect because of such small differences in length; however, peaks can be seen at various lengths in most of the areas surveyed. These peaks are best seen in the data collected for Placentia and Catalina (Figure 6- Appendix D). The year classes in both cases are 3-4cm apart. Information regarding age will be valuable in supporting the suggested year classes if an adequate sample of vertebrae can be successfully aged. Age grouping is especially important when assessing the lumpfish roe fishery since a successful fishery, during which

a large number of spawners are removed, can result in poor year classes in the future.

Several lumpfish measuring 3-5cm in length were recorded at various locations on the Island portion of the Province, however, no female lumpfish were taken in the 6-34cm range despite experimental fishing with a range of mesh sizes. Furthermore, fishermen reported that lumpfish found along our shores tend to be either the large commercial size or extremely small, the latter being captured attached to ropes or seaweed. The apparent absence of intermediate sizes of lumpfish is likely due to the peculiar life cycle. It is generally assumed that after hatching and developing to a certain size, the lumpfish migrates into deeper water and undergoes further growth, returning inshore to spawn when sexually mature. It is not known if they migrate to the same area each year; however, the recapture of fish tagged in 1981 may provide the answer to this question.

Mature lumpfish likely migrate inshore in large pelagic schools. These were reported by several fishermen who had seen schools of lumpfish swimming just under the water surface, and also by M.V. Oderin in 1981 from a reported catch of a large quantity off Cape St. Francis. Many fishermen on the Northeast Coast believe that the lumpfish follow the northern ice packs inshore in the early spring. Evidence for this is lumpfish carcasses left on the ice by seals, a common sight at the "Front"* in the early spring during

*An area off the Northeast coast of Nfld. where the annual seal hunt harvest takes place.

the seal hunt. A check revealed that, during 1979, ice conditions along the Northeast Coast were heavy and since then have been light. This corresponds to catches of lumpfish in the area that were the highest ever in 1978 but decreased drastically in the past 3 years. However, it is important to note that sufficient evidence is not available to substantiate a relationship between ice conditions and lumpfish migrations and further studies would be required.

The roe yield of lumpfish varied from 20.4 to 29.2% of total weight with the average being 25.4% (See Table 10 - Appendix D). It should be noted that the yield is dependent upon a number of factors such as (1) the time of the season at which the yield is calculated (when the lumpfish first migrate inshore the eggs are small, but with time the eggs increase in size to the point where the belly is swollen and eggs protrude through the vent) and (2) not all fish mature at the same time, thus a certain number of fish are immature and others are post-spawners. In order to determine the time of maximum roe yield, an area would require sampling throughout the fishing season. The peak period of maturity may differ greatly from area to area depending on existing water temperatures. (Note: Lumpfish lay their eggs when water temperatures reach $4^{o}C$, Collins, 1975).

There have been reports from fishermen of mature lumpfish being taken in September and October and one such lumpfish was recorded at Ship Harbour, Placentia Bay on August 15, 1981.

By-Catch

Lumpfish fishermen report catching small quantities of catfish, flounder and cod. In several areas notably Placentia Bay and Bay St. George, good catches of skate were taken. Although some of the fishermen were successful in obtaining a market for skate wings, others such as the fishermen in Codroy discarded them due to lack of a market. Table 11, Appendix D contains excerpts from fishermen's reports showing by-catches of skate and flounder.

SUMMARY

On a Province- wide basis the lumpfish fishery of 1981 was a successful one yielding 728,433kg of roe. The failure of the North-east Coast fishery was compensated for by a very successful year along the South Coast. Total landings were up 73% over 1980 and recently developed areas accounted for the majority of the catch whereas traditional areas had low catches.

The development of a secondary processing industry in Newfoundland is presently being studied. This would provide additional income from the fishery and allow the Province to enter a higher priced market rather than exporting the product in a semi-processed form.

Exploratory fishing was carried out in two areas of the Province. In Cartwright, Labrador the total catch of 22 lumpfish in 60 net days was considered too low to support a commercial fishery, especially since the lumpfish were extremely small and contained very little roe per fish. Exploratory fishing in Trepassey in late June revealed that there were very few lumpfish in the area. This may have been due to the lateness of the season. The fishermen involved plan to try the fishery again next year commencing in May.

Catch per unit effort statistics were compiled to determine the most productive area of the Province. They revealed a trend towards lower catches in areas that had been fished for a number of years as opposed to newly developed areas. This is to be expected; however, if the catch decreases to the point where it is not worth the effort, then a commercial fishery is no longer viable. A successful fishery should have a catch per unit effort of not less than 4 - 5kg of roe per net day.

To obtain information on lumpfish stocks the Department conducted limited biological data collection and tagging operations to monitor migration patterns and stock size. Although fish were tagged in 4 areas only Grand Bank experienced successful tagging. There 514 fish were tagged. To date, only one fish has been recaptured.

Biological data shows that the lumpfish decreases in length in northward latitudes. This is common in some species of fishes and may be useful to separate stocks of lumpfish. Cartwright can be separated from the other areas on the basis of average lengths of maturity. This, together with other data such as meristic counts and ages will eventually be used in a multi-variate stock assessment of the lumpfish populations around our coast. Stock assessment is essential if we are to continue to develop the fishery to its full potential.

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APPENDIX A

Table 3 : 1981 roe Yield and dollar Value from various geographical Areas.

Region	Amount of Roe Landed	% of Total	Value
North-East Coast	105,498kg. 232,580lbs.	14.5%	$ 74,425.00
Avalon Peninsula	1,406kg. 3,100lbs.	1%	$ 992.00
South Coast	420,260kg. 926,500lbs.	58%	$296,480.00
South-West	123,704kg. 272,717lbs.	17%	$ 87,269.00
Northern Peninsula	77,565kg. 171,000lbs.	10.5%	$ 54,720.00
Total	728,433kg. 1,605,897lbs.	100%	$513,887.00

Table 4: Newfoundland lumpfish roe Production in kilograms and dollar Value, 1970-1981*.

Year	Quantity		Landed Value (dollars)
	kgs.	(lbs.)	
1970	21,470	(47,711)	4,925
1971	154,680	(343,734)	33,205
1972	202,864	(450,810)	53,274
1973	152,464	(338,810)	50,994
1974	59,753	(132,784)	22,821
1975	93,228	(207,173)	41,131
1976	317,727	(706,060)	148,272
1977	499,136	(1,109,191)	277,298
1978	926,768	(2,059,486)	576,676
1979	565,320	(1,256,266)	348,237
1980	417,375	(927,500)	275,467
1981	728,433	(1,605,897)	513,887

* 1970-78 Statistics Division, Federal Fisheries & Oceans.

1979-81 Provincial Department of Fisheries.

APPENDIX B

Results

Table 5: Results of exploratory Fishing in Cartwright

Area	Date Hauled	Net Days	# of Lumpfish	Condition	Bycatch	Water Depths (m)
1	22/6/81	2	1	Ripe	1 Rock Cod	4
2	22	2	-	-	2 Skate	5
3	22	2	-	-	-	4
4	23	2	1	Ripe	2 Skate	7
5	23	2	-	-	-	6
6	23	2	1	Ripe	-	8
7	24	4	-	- -	-	4
8	24	4	1	Male	1 Skate	6
9	24	4	1	Male	-	13
10	24	2	-		-	10
11	25	2	2	Immature	-	8
12	25	2	1	Immature	-	4
13	25	2				4-6
14	25	2	1	Ripe	3 Skate	15
15	25	2	1	Male	1 Skate 1 Rock Cod	6
16	26	2	1	Ripe		10
17	26	2	4	Ripe		7
18	26	2	1	Ripe		7
19	26	2	1	Ripe	1 Rock Cod	8
20	26	2	1	Ripe		4
21	28	2	1	Ripe	1 Skate	4
22	28	2	0			14
23	28	2	1	Ripe		6
24	29	2	1	Ripe	1 Skate	12
25	29	2	1	Ripe		4
26	29	2				7
27	29	2				6

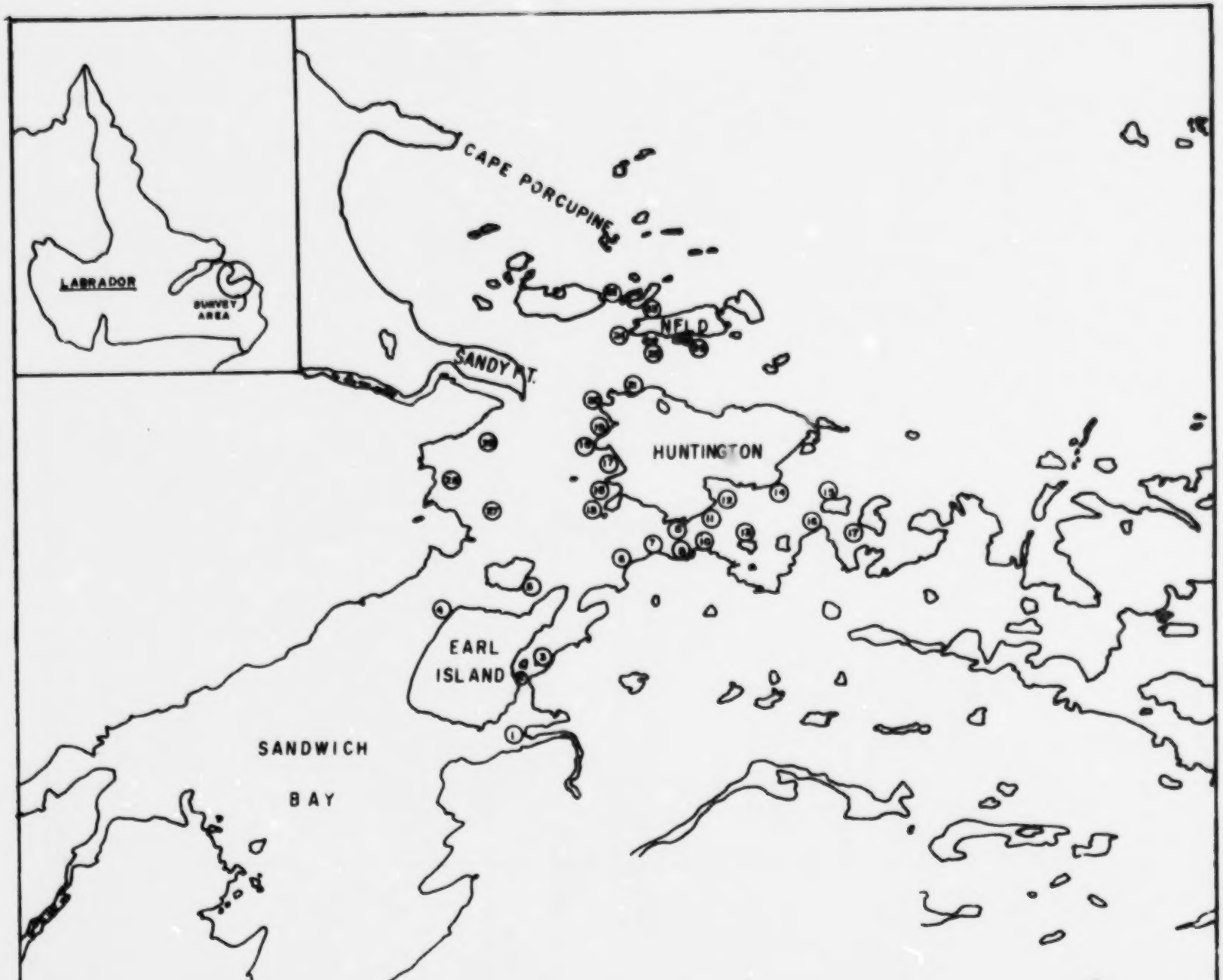
Note: One net day is a 50 fathom net fishing for a 24 hour period

Table 6 : Results of exploratory Fishing in Trepassey

Area	Date Hauled	Net Days	# of Lumpfish	Condition	Bycatch	Water Depth (fms)
1	18/6/81	10	4	Spawned Out (5.0)	150 Flounder	22
2	19	10	-	-	-	4
3	24	50	1	" "	1 Skate	7-8
4	25	10	-	-	2 Skate	3-4
5	26	10	-	-	-	4-5
6	27	10	-	-	1 Skate	7
7	29	20	-	-	-	9
8	30	10	2	5.0	-	6-9
9	1/7/81	10	1	5.0	2 Skate	11
10	2	10	1	5.0	3 Flounder	14
Total		150	9	-	153 Flounder 6 Skate	

Note: 1 net day is one 50 fathom net fishing for a 24 hour period.

Figure 3: Cartwright Survey Area, 1981.



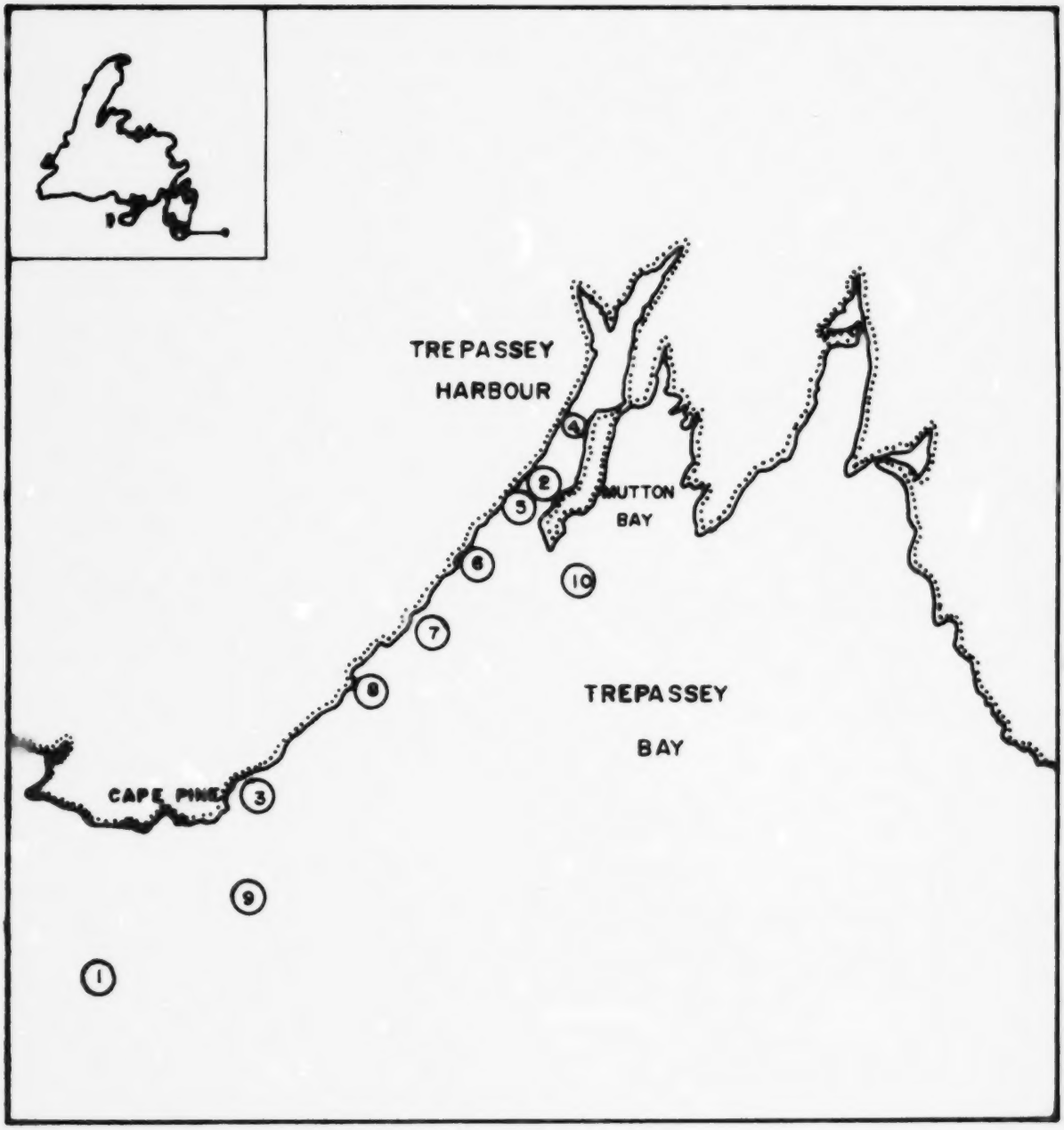


Figure 4: Trepassey Area showing net Locations during exploratory Fishing, 1981.

APPENDIX C

Table 7 : Lumpfish versus Herring as Bait for use in lobster Pots

Date	Yield			
	Herring Bait	Catch Ratio (%)	Lumpfish Bait	Catch Ratio (%)
May 25	45 Traps 17 Lobsters	37.7%	25 Traps 3 Lobsters	12%
May 26	45 Traps 8 Lobsters	17.7%	21 Traps 3 Lobsters	19.4%
May 27	45 Traps 22 Lobsters	48.8%	21 Traps 6 Lobsters	29%

Table 8: Lumpfish versus Squid as Bait for catching Cod.

Bait Used	Date	Location	No. of Fish Caught	No. of Lines	No. of Hooks	Water Depth (fm)	Yield Per Line	Baiting Efficiency
Squid	14/10/81	Renews	712	36	3096	15	19.7 fish	95%
Lumpfish	14/10/81	Renews	12	6	516	15	2.0 fish	70-80%

APPENDIX D

Table 9: Variations in Length as related to Latitude.

Length	Grand Bank	Placentia	Bell Island	Catalina	Codroy	St. Anthony	Cartwright
25cm							1
28							4
29							8
30							
31							4
32							
33							3
34							1
35		1		1		1	1
36	1	1	1	3		3	
37		2		6		4	1
38				7		9	
39	1	2	2	11	2	5	
40	4	7		23	5	9	
41	12	15		23	7	5	
42	9	8	2	26	13	10	
43	22	7	4	14	4	4	
44	24	9	4	15	8	3	
45	34	13	1	26	10	1	
46	34	11	2	18	7	0	
47	24	9		10	8	1	
48	44	2		7	8	1	
49	50	4		4	9	1	
50	32	2	1	3	4	1	
51	50	2		2	3		
52	41		1	1	2		
53	43		1		1		
54	23						
55	23				1		
56	18						
57	8						
58	8						
59	2						
60	4						
64	1						
$\bar{X}$	49.4	43.8	44.1	42.9	45.4	40.6	30.3
Lat.	47° 10"	47° 13"	47° 35"	48° 25"	47° 55"	51° 20"	53° 41"

Table 10: Roe Yield and average per cent of the total weight from lumpfish Samples taken in the various Regions.

Place	Area	Date	# of Fish	Avg.wgt of Roe (kg)	Average % of Roe Yield
Fox Harbour Fox Harbour	Placentia Bay	May 13 June 1	70 30	.99 .70*	27.0 20.4
Bell Island	Conception Bay	May 7	19	.97	24.2
Catalina	Trinity Bay	May 21	100	1.02	29.2
St. Anthony	Great Northern Peninsula	June 10	58	.88	27.9
Codroy	S.W. Coast	May 25	100	.76	20.8
Totals			377	.91	25.4
Wesleyville	Bonavista Bay	May 26,1979	50	1.18**	27.5

*Some of the fish were post spawners thus roe yield was lower.

**Data supplied by Mr. George Kean of Federal Fisheries and Oceans.

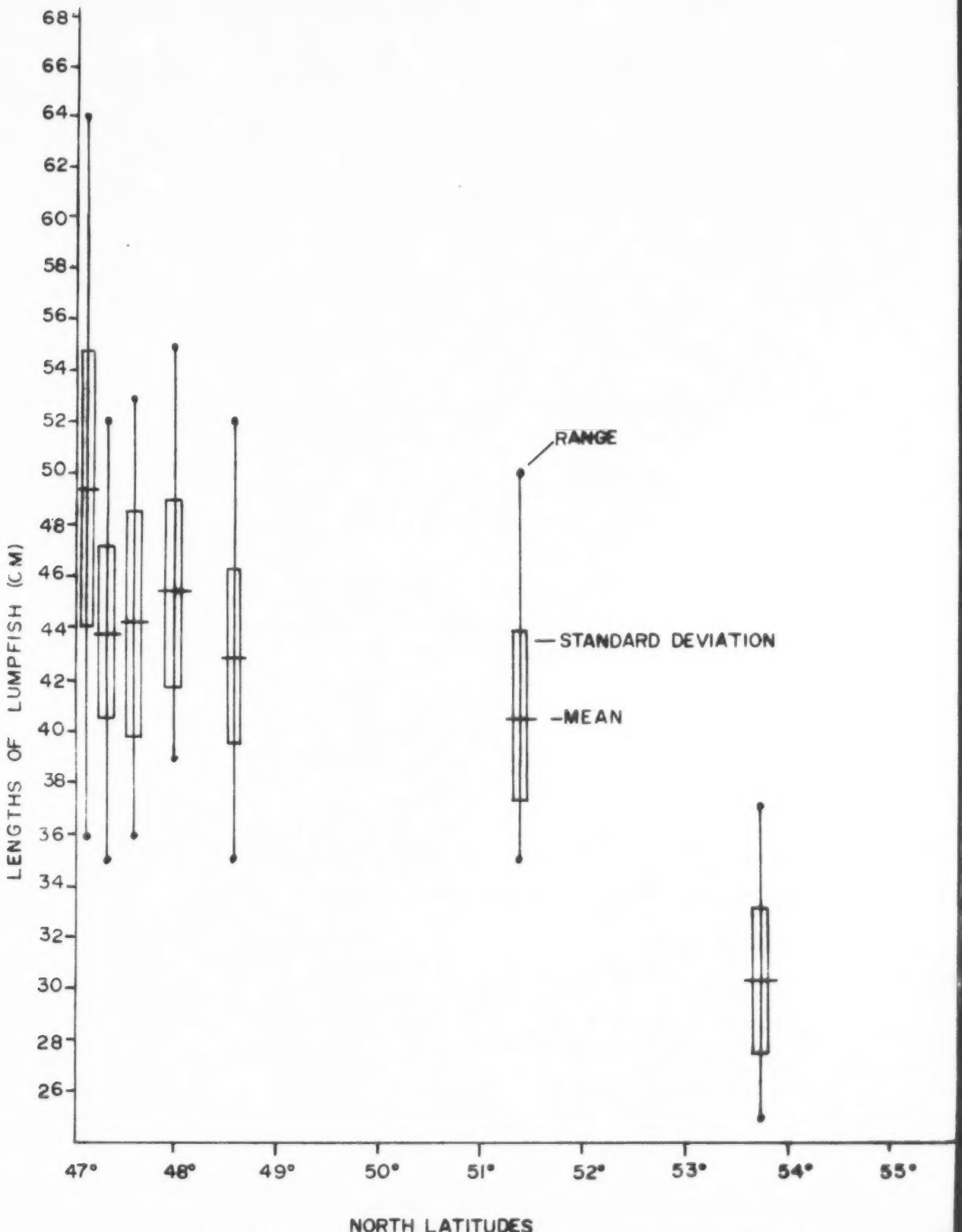
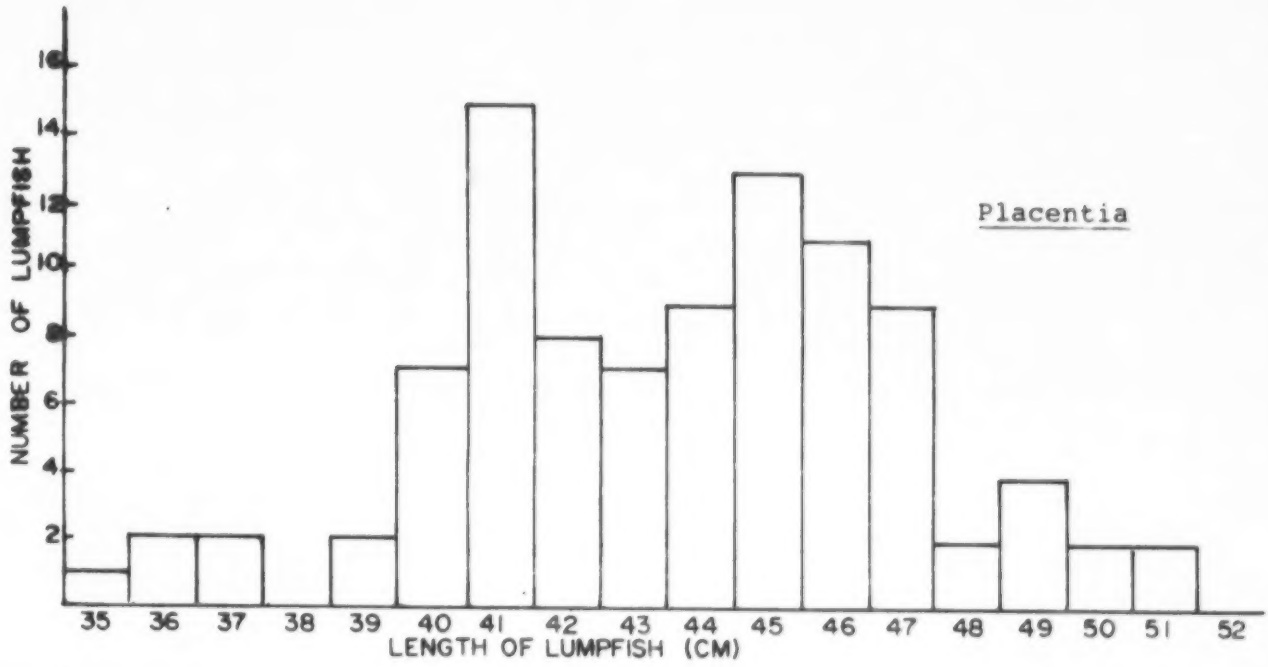


Figure 5: Relationships of Latitude to Length in lumpfish samples taken in 1981.



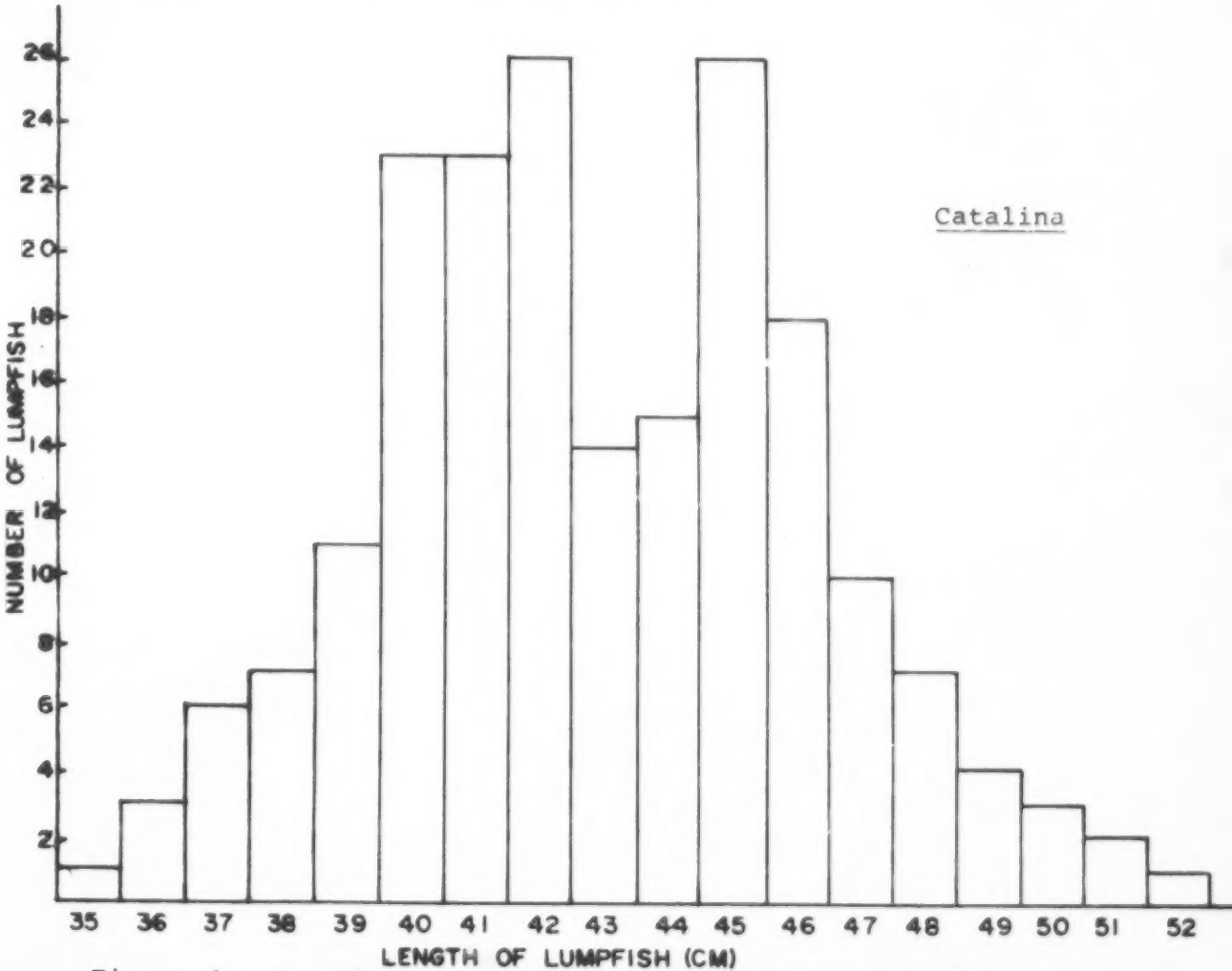


Figure 6: Length Frequencies for Lumpfish taken in Placentia

Table 11: By-catch of Skate and Flounder from lumpfish Nets used by Fishermen in 5 Locations during 1981.

Location	No. of Fishermen	Catch (kg)		
		Lumpfish*	Skate (wings)	Flounder (round)
Codroy	1	45,133	742	
Red Harbour	1	3,240	563	
St. Lawrence	1	4,784	173	216
St. Mary's	1	248	1,178 (Skate and Flounder combined)	
Placentia	1	151	347	462

*The weight of lumpfish was obtained by multiplying the number of fish by the calculated average weight of a lumpfish using data contained in Table 10.

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